AMELX gene

amelogenin, X-linked

Normal Function

The *AMELX* gene provides instructions for making a protein called amelogenin, which is essential for normal tooth development. Amelogenin is involved in the formation of enamel, which is the hard, white material that forms the protective outer layer of each tooth. Enamel is composed mainly of mineral crystals. These microscopic crystals are arranged in organized bundles that give enamel its strength and durability. Although the exact function of amelogenin is not well understood, it appears to separate and support the crystals as they grow. Amelogenin is removed from the developing crystals when it is no longer needed, leaving mature enamel that contains very little protein.

One copy of the amelogenin gene is located on each of the sex chromosomes (the X and Y chromosomes). The *AMELX* gene, which is located on the X chromosome, makes almost all of the body's amelogenin. The copy of the amelogenin gene on the Y chromosome, *AMELY*, makes very little amelogenin and is not needed for enamel formation.

Health Conditions Related to Genetic Changes

amelogenesis imperfecta

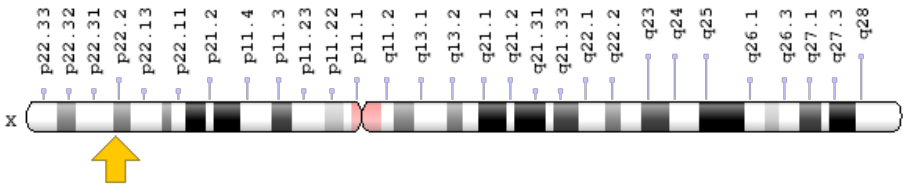
At least 23 mutations in the *AMELX* gene have been identified in people with an X-linked form of a disorder of tooth development called amelogenesis imperfecta. (X-linked disorders are caused by mutations in genes on the X chromosome.) Some *AMELX* gene mutations lead to the production of an abnormal version of the amelogenin protein that can interfere with the formation and organization of enamel crystals. Other *AMELX* gene mutations prevent one copy of the gene from producing any amelogenin protein at all. Enamel cannot form properly without an adequate amount of amelogenin.

Males have a single copy of the X chromosome in each cell. Males who inherit an altered copy of the *AMELX* gene have very little amelogenin and develop almost no enamel to cover and protect their teeth. (The normal *AMELY* gene on the Y chromosome does not provide enough amelogenin to compensate.) Females have two copies of the X chromosome in each cell. Females who inherit one altered copy of the *AMELX* gene are less severely affected than males because they have a normal copy of the gene on the other X chromosome to produce amelogenin. Their tooth enamel may have structural defects such as a distinctive pattern of vertical grooves.

Chromosomal Location

Cytogenetic Location: Xp22.2, which is the short (p) arm of the X chromosome at position 22.2

Molecular Location: base pairs 11,293,413 to 11,300,761 on the X chromosome (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- AIH1
- ALGN
- amelogenin (amelogenesis imperfecta 1, X-linked)
- AMELX_HUMAN
- AMG
- AMGL
- AMGX

Additional Information & Resources

Educational Resources

- School of Dentistry, University of North Carolina at Chapel Hill https://www.dentistry.unc.edu/dentalprofessionals/resources/defects/ai/#research

Scientific Articles on PubMed

- PubMed https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28AMELX%5BTIAB%5D%29+OR+%28amelogenin%5BTI%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D

OMIM

- AMELOGENIN
  http://omim.org/entry/300391

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_AMELX.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=AMELX%5Bgene%5D
- HGNC Gene Symbol Report
  http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=461
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/265
- UniProt
  http://www.uniprot.org/uniprot/Q99217

Sources for This Summary

- Hu JC, Chan HC, Simmer SG, Seymen F, Richardson AS, Hu Y, Milkovich RN, Estrella NM, Yildirim M, Bayram M, Chen CF, Simmer JP. Amelogenesis imperfecta in two families with defined AMELX deletions in ARHGAP6. PLoS One. 2012;7(12):e52052. doi: 10.1371/journal.pone.0052052. Epub 2012 Dec 14.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/23251683
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3522662/
- Kida M, Sakiyama Y, Matsuda A, Takabayashi S, Ochi H, Sekiguchi H, Minamitake S, Ariga T. A novel missense mutation (p.P52R) in amelogenin gene causing X-linked amelogenesis imperfecta. J Dent Res. 2007 Jan;86(1):69-72.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17189466
- Lakshminarayanan R, Bromley KM, Lei YP, Snead ML, Moradian-Oldak J. Perturbed amelogenin secondary structure leads to uncontrolled aggregation in amelogenesis imperfecta mutant proteins. J Biol Chem. 2010 Dec 24;285(52):40593-603. doi: 10.1074/jbc.M110.131136. Epub 2010 Oct 7.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/20929860
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3003358/
- Margolis HC, Beniash E, Fowler CE. Role of macromolecular assembly of enamel matrix proteins in enamel formation. J Dent Res. 2006 Sep;85(9):775-93. Review.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16931858
- Wright JT, Li Y, Suggs C, Kuehl MA, Kulkarni AB, Gibson CW. The role of amelogenin during enamel-crystallite growth and organization in vivo. Eur J Oral Sci. 2011 Dec;119 Suppl 1:65-9. doi: 10.1111/j.1600-0722.2011.00883.x.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/22243229
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3293103/

- Wright JT, Torain M, Long K, Seow K, Crawford P, Aldred MJ, Hart PS, Hart TC. Amelogenesis imperfecta: genotype-phenotype studies in 71 families. Cells Tissues Organs. 2011;194(2-4): 279-83. doi: 10.1159/000324339. Epub 2011 May 19.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/21597265
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3178091/
- Wright JT. The molecular etiologies and associated phenotypes of amelogenesis imperfecta. Am J Med Genet A. 2006 Dec 1;140(23):2547-55. Review.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16838342
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1847600/

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